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**SANDIA NATIONAL LABORATORIES
CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL PROCEDURE (TP)**

TP-264

**DATA ACQUISITION SYSTEM CALIBRATION AT
NEW ENGLAND RESEARCH, INC.**

Revision 0

Effective Date: 10/09/03

Original Signed by Peter J. Boyd
Author: Peter J. Boyd

10/03/03
Date

Original Signed by Ronald H. Price
Technical Reviewer: Ronald H. Price

10/03/03
Date

Originals Signed by James F. Graff
Quality Assurance Reviewer: James F. Graff

10/03/03
Date

(Reviewer signatures above document the review and resolution of comments.)

REVISION HISTORY

<u>Revision</u>	<u>Description</u>
0	Initial issue

1.0 Scope and Objective

The objective of this Technical Procedure (TP) is to define the process for New England Research, Inc. (NER) to calibrate voltage recording data acquisition systems (DAS). This procedure is intended for implementation in a laboratory environment, in conjunction with work for the Yucca Mountain Project (YMP).

2.0 Prerequisites

Before performing work under this technical procedure, personnel must be trained by the author and/or the Principal Investigator (PI), and they must demonstrate their proficiency in performing the work in this procedure. The PI has the responsibility for generating a record of the personnel proficiency training, as well as the responsibility that work is performed and documented in accordance with this procedure.

The personnel using this procedure are responsible for ensuring that a controlled copy of this procedure is available and used for performing the work in this procedure.

3.0 Description of Activity

This TP details procedures for verifying an accurate recording of voltage change on each recording channel of computer based data acquisition systems. The DAS records voltages from transducers and other devices used in conjunction with rock property measurements conducted in the laboratory. Each device operates with a full-scale output of 0 to 10 volts dc. The purpose of the calibration will be to ensure that the change in voltage recorded by the DAS accurately corresponds to varying outputs from a voltage source. The voltage source output will be measured with a voltmeter that has been calibrated with traceability to the National Institute of Standards and Technology (NIST).

The output from the voltage source will be supplied to each channel of the DAS. Voltages varying between 0 and 10 volts dc will be used. The input voltage and the voltage displayed by the DAS will be recorded. The observed data, as a function of the reference data, will be evaluated. A least squares linear fit to the data will be determined. The slope of the least squares fit shall be 1.000 ± 0.005 v/v in order for that channel to be acceptable for data collection.

4.0 Activity Process

All calibration information will be recorded on the DAS Calibration Data Sheet (DCDS, in Appendix A) in accordance to the requirements specified in AP-12.1Q, Control of Measurement and Test Equipment and Calibration Standards.

1. Provide the identification and traceability information requested on the DCDS.
2. Disconnect the DAS input connector from the signal conditioning amplifiers used for strain, force, displacement, pressure, etc.
3. Insert a sixteen pin, jumpered in series, connector into the DAS input connector.

4. Connect the voltage source output to the sixteen pin connector, thereby allowing the simultaneous application of the voltage to all sixteen recording channels.
5. Set the standard voltage source to a nominal output of 1.0 volt and measure the voltage with a calibrated voltmeter. Record the actual reference input voltage on the DCDS.
6. With a stable voltage being input to the DAS, record the voltages indicated by the DAS for all sixteen channels. This data is tabulated on Section 2 of the DCDS.
7. Repeat Steps 5 and 6 while increasing the output voltage of the source according to the schedule tabulated in Section 2 of the DCDS. Measure, and record the reference input voltage each time the voltage is increased.
8. For each DAS channel, compute the least squares linear fit to the observed output vs the reference data. Record the results on the DCDS.
9. There may be an offset between the input value and the voltages recorded. It is the correspondence of the change in voltage that determines the validity of the DAS as a data recorder. Results are acceptable if the slope of the least squares linear fit to the data for each channel is equal to 1.000 ± 0.005 v/v.
10. An in specification DAS shall be labeled to indicate its calibration status. The label shall be affixed to the CPU of the DAS, and shall include:
 - a) Make/Model/Serial Number of DAS
 - b) Date of most recent calibration
 - c) Due date of next calibration
 - d) Name/Signature of operator who performed calibration
11. Should a single channel of the DAS be found to be out of specification, that channel will not be used in data collection activities. If there are not enough in specification channels for the DAS to be used for data acquisition, the entire system will not be used until there is a satisfactory resolution of the problem.

5.0 Safety

There are no special safety hazards, only the normal hazards of the equipment. Operations will be in accordance with safety requirements of the facility where the work is being performed and that of the employer of person(s) performing the work.

6.0 Nonconformances, Deviations, and Corrective Actions

Any nonconformances or deviations must be reported to the PI as soon as possible. Deviations, deficiencies and corrective actions must be determined and documented in accordance with AP-16.1Q, *Condition Reporting and Resolution*.

7.0 QA Records

QA records, and any corrections or changes thereto, generated as a result of implementing this procedure will be prepared and submitted as inclusionary QA records (QA:QA) by the PI in accordance with AP-17.1Q, *Records Management*.

The QA records include:

- Proficiency training records (Section 2.0)
- Calibration records
- DAS Calibration Data Sheets (DCDS) (Appendix A)

8.0 References

AP-12.1Q, *Control of Measuring and Test Equipment and Calibration Standards*

AP-16.1Q, *Condition Reporting and Resolution*

AP-17.1Q, *Records Management*

Appendix A

Page ____ of ____

DAS CALIBRATION DATA SHEET (DCDS)

Section 1 of 2 – Identification / Traceability

Make/Model/Serial # of DAS to be calibrated: _____

Date of calibration: _____ Date of last calibration: _____

Make/Model/Serial # of calibrated standard voltmeter: _____

Date of last calibration of standard voltmeter: _____

Based on deviations from the tolerances (see Section 2 of DCDS), the DAS is (check one):

In Specification _____ Out of Specification (Not enough acceptable channels) _____

Note: If "In Specification", the DAS calibration is completed, and the DAS is acceptable for use in data collection. If "Out of Specification", then perform troubleshooting operations, and correct and note the problem. Rerun the calibration, and take appropriate steps to mark data collected with this DAS since the previous calibration.

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Appendix A

Page ____ of ____

DAS CALIBRATION DATA SHEET (DCDS)

Section 2 of 2 – Calibration Verification Data

DAS Make/Model/Serial #: _____

Nominal / Actual Input (v)	Channel 1 Output (v)	Channel 2 Output (v)	Channel 3 Output (v)	Channel 4 Output (v)	Channel 5 Output (v)	Channel 6 Output (v)	Channel 7 Output (v)	Channel 8 Output (v)
1/ _____								
3/ _____								
5/ _____								
7/ _____								
9/ _____								
Least Squares Fit:								
Acceptable? Y/N:								

Nominal Input (v)	Channel 9 Output (v)	Channel 10 Output (v)	Channel 11 Output (v)	Channel 12 Output (v)	Channel 13 Output (v)	Channel 14 Output (v)	Channel 15 Output (v)	Channel 16 Output (v)
1/ _____								
3/ _____								
5/ _____								
7/ _____								
9/ _____								
Least Squares Fit:								
Acceptable? Y/N:								

There may be an offset in the voltages recorded. The correspondence of the change in voltage determines the validity of the DAS as a data recorder. Results are acceptable if the slope of the least squares linear fit to the data for each channel is equal to 1.000 ± 0.005 v/v.

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